REVIEW ARTICLE

IMPLEMENTATION OF ENHANCED RECOVERY AFTER SURGERY PROTOCOL FOR METABOLIC SURGERY PATIENTS (LITERATURE REVIEW)

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ABSTRACT

The article reviews the literature highlighting modern views on the issues of postoperative rehabilitation of patients after metabolic surgical interventions. The concept of accelerated postoperative recovery of patients is presented as a single integral system of principles, means and methods of multidisciplinary work in the perioperative period aimed at reducing the time of hospitalization of patients and reducing the financial costs of the healthcare system. The separate components of the protocol of accelerated postoperative recovery from the standpoint of evidence-based medicine are analyzed, an emphasis is made on its specificity in metabolic surgery. The key role of laparoscopic access at the present stage of development of metabolic surgery is emphasized. Specific risk factors have been identified in patients with obesity, type 2 diabetes mellitus and metabolic syndrome, which can affect the effectiveness and safety of surgical treatment, especially in conditions of early discharge from the hospital. Attention is focused on the extremely important, but still controversial positions of the protocol, requiring further research to form a better evidence base and clear practical recommendations. The promising directions of scientific research for improving both the system of accelerated postoperative recovery as a whole and its individual elements are demonstrated. Electronic databases of Scopus and PubMed were searched using keyword searches. The analysis of the literature has shown the feasibility of introducing, systemic use and further improvement of the protocol for accelerated postoperative recovery in metabolic surgery.

KEY WORDS: metabolic surgery, enhanced recovery after surgery

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INTRODUCTION

According to the WHO data, in 2016 the number of overweight adults in the world exceeded 1.9 bln persons (39% of population of our planet aged over 18), among whom 650 mln (13%) were suffering from obesity. The above statistical data coupled with catastrophic dynamics of this illness spread allowed the professionals to characterise the problem of overweight as a "non-infectious pandemic" of today's world [1].

The proven overall negative medical and social effects of obesity and related numerous illnesses and metabolic disorders (primarily cardiovascular pathologies and type 2 diabetes) [1,2] became a powerful impetus to develop new approaches to metabolic syndrome treatment.

One of the most effective modern methods of treatment of such patients is metabolic surgery. Metabolic surgery is a group of surgical procedures performed on gastrointestinal tract organs in order to change topographic anatomy thereof, digestion processes physiology and impacting incretin condition of gaster and intestines and allowing weight loss, correction of diseases collateral to obesity and metabolism disorders. At the same time, one of the main "target areas" of the above surgery became treatment of type 2 diabetes [3].

Over the last decade, metabolic surgery continued to demonstrate rapid and consistent evolution, where an important role had implementation of laparoscopic access to Enhanced Recovery After Surgery protocol (ERAS), among other achievements [4]. Development of ERAS became a logical result of fast-track surgery concept evolution proposed by Kehlet et al. in the 90s of the last century and used for colorectal surgery. Intensive research proving effectiveness (including cost-effectiveness) and safety of the above approach led to quite expeditious implementation of ERAS in practically all surgery areas [5].

According to the definition, ERAS (Enhanced Recovery After Surgery) is a multimodal integrated patient management system aimed at reducing postoperative stress, accelerating physical and psychological recovery, reducing financial burden on national healthcare systems, primarily

by reducing the time of patients' stay in hospitals [6].

ERAS consist of separate elements (principles, means and methods of multidisciplinary management of patients during preoperative, intraoperative and postoperative periods), which due to their synergy ensure achieving the above goals. It is also worth noting that ERAS system is implemented according to the "all or nothing" principle, which means that it's proper functioning is possible only when implementing in practice all of its elements without any exceptions. First general recommendations on the use of ERAS in metabolic surgery, which were published in 2016 [6], are undoubtedly require close analysis mostly due to the specific nature of patients and goals of the metabolic surgery.

THE AIM

The aim of this study was to analyse the literature data highlighting modern views on the issues of postoperative rehabilitation of patients after metabolic surgical interventions.

REVIEW AND DISCUSSION

PREOPERATIVE PERIOD

INFORMATION, EDUCATIONAL AND CONSULTATIVE WORK WITH A PATIENT.

The main goal of preoperative period in ERAS system is comprehensive preparation of the patient for the surgery. The objective is to correct not only physical, but also mental condition of the patient via consultation and awareness-raising work with the patient, which is advisable to be commenced 2-3 months before surgery [5]. Such "early commencement" of information and educational support of potential candidates for surgical treatment is, on the one hand, explained by a broad range of issues, requiring to be addressed, and on the other hand, by mental particulars of patients most evident in type 2 diabetes patients. Such patients very often demonstrate cognitive disorders, poor attention and memory [7], anxiety at the stage of waiting for the surgery, which leads to the fact that they absorb only 10% of information provided by the doctor during a single consultation. Therefore, in view of the above, it seems logical to organise a series of consultations with repeated addressing of important issues whenever necessary.

During the preoperative period, a patient should receive comprehensive information on contemporary metabolic surgery procedures and on specific surgery planned to be conducted. A particular emphasis should be placed on the high level of safety of modern metabolic surgery, particulars of anaesthetic support, absence in most cases of the need for prolonged stay in a hospital, the possibility of solving most issues remotely with a 24/7 support by calling a designated contact telephone number, and the rules of conduct at home [8].

The expected positive effect of the surgery without omitting any possible complications and adverse effects of the surgery should be explained to the patient in details. There should be also further detailed discussion on the success factors of the surgery, realisation of which in many aspects relies on the actions of the patient, such as diet correction, particulars of postoperative monitoring, change of lifestyle, possible drug support for avoiding postoperative deficiency conditions [9].

At present, due to the lack of randomised clinical research, the positive impact of the above information and awareness-raising work with the patient on the rate of complications, duration of stay in a hospital, anxiety levels and mental discomfort, cannot be deemed proven. However, it can be stated with certainty that in the process of such interaction, preconditions for assessment and correction of patient's compliance, if necessary, are created. This is due to the fact, that many elements of ERAS at the preoperative stage that are aimed at improving patient's physical condition, concurrent diseases and prevention of perioperative complications, require specific actions to be taken by the patient on their own. Strive to follow all doctor's recommendations demonstrated by taking specific actions is the most evident proof of patient's readiness to work towards achieving the planned result [10].

PREOPERATIVE DIET AND WEIGHT LOSS.

Recommendations on weight loss as an element of metabolic surgery preparation seem logical due to several reasons. In particular, preoperative weight loss allows broadening the range of physical activity of the patient and the possibility to improve functional reserves of the cardiovascular and respiratory systems respectively [11]. Decrease of visceral fat in the abdominal cavity and size of the left part of liver facilitates visualisation of the operating field and the use of laparoscopic surgery technique [12]. Preoperative decrease of the body mass index and creation of potentially conducive conditions for the decrease of the surgery duration may be perceived to a certain extent both as prevention of rhabdomyolysis syndrome and venous thromboembolism [12].

The key instrument in excess weight loss is the low-calorie and very low-calorie diet with limiting daily energy value of meals up to 1,000–1,200 kcal and 800 kcal respectively and provision of energy needs of a patient by predominantly or solely with proteins for a period of 2 to 4 weeks [13]. At the same time, patients suffering from type 2 diabetes require specific attention due to increased risk of hypoglycaemia as a result of intake of standard doses of blood glucose lowering drugs [7].

In general, results of many research papers show that preoperative decrease of body mass index leads to significant decrease of the rate of early complications after the surgery and, in addition to the above, is a prognostic factor for more substantial weight loss during the following postoperative period [14].

PHYSICAL EXERCISES.

An important factor of preoperative preparation is physical exercises aimed at increasing functional reserves of the body in order to ensure quick recovery after the surgery-in-

duced stress. Positive impact of physical exercises on the postoperative course is theoretically connected to the improvement of cardiovascular reserves (increase of systolic discharge and decrease of heart rate (HR)), improvement of endothelial function and oxygen consumption, increase of muscle mass [15].

Results of a range of randomised controlled research in the field of colorectal surgery proved a correlation between the physical exercises (4 to 8 weeks on average) and the decrease of postoperative complications, the hospital mortality, shortening the duration of inpatient treatment and physical rehabilitation of patients. At the same time, it is worth noting that in some papers the reliability of such a correlation is in fact denied [16].

The above non-homogeneity of the obtained results, lack of randomised clinical research in this area, doubts in the correctness of projection of the available data on the metabolic surgery, still do not allow reaching unambiguous conclusions on the exact impact of physical exercises on rapid postoperative recovery of such patients. It is worth pointing out among important, but still unsolved issues, insufficient structuring of training programs, the need to bring them in line with the physical capabilities of a specific patient, and organisation of professional control over the completion of the set exercises [16].

ALCOHOL AND SMOKING.

Strict recommendations regarding refraining from smoking at least 30 days prior to the surgery are based on very reliable evidence confirming significant increase of postoperative complications and mortality among smokers [17].

According to the results of numerous research papers, the negative impact of alcohol abuse (3 and more doses of 12 grams of ethanol each) on the course of postoperative period was also found, as well as improved treatment results in colorectal surgery when a patient refrained fully from alcohol consumption at least 1 month prior to the surgery. The particulars of patients and surgery procedures in the metabolic surgery requires much longer period (from 1 to 2 years) of refraining from alcohol consumption. However, confirmation or refutation of this hypothesis requires further research [18].

GLUCOCORTICOIDS.

Preoperative prescribing of glucocorticoids in the ERAS system is explained by its anti-inflammatory and antiemetic action. A number of research papers demonstrated that use thereof leads to decrease of surgical complications rate and the duration of inpatient treatment of patients. At the same time, in order to prevent postoperative nausea and vomiting, it is deemed sufficient to perform bolus injection of 2.5–5 mg of dexamethasone 90 minutes prior to administration of general anaesthesia [19]. However, according to the actual data, such doses of drugs are not enough to suppress the systemic inflammatory response syndrome after surgery. At the same time, use of 8–10 mg of dexamethasone leads to significantly increased risk of hypoglycaemia and, as a result, infectious postoperative complications. Contra-insular effects of glucocorticoids are especially important to consider in respect of type 2 diabetes patients and substantiate the need of systematic monitoring of proper correction of hypoglycaemia level for such patients during the perioperative period [20]. In general, the particulars of patients in metabolic surgery call for the need to conduct further research aimed at performing objective assessment of the risks and benefits of preoperative administration of glucocorticoids.

CARBOHYDRATES LOAD.

Utilisation of carbohydrates load method consisting in consumption of 200–300 ml of isosmolar sweet drinks 2-3 hours prior to the surgery is aimed at reducing the phenomenon of postoperative insulin resistance and protein loss. According to the results of a number of meta-analyses, such approach allows reducing the duration of stay in a hospital after "large-scale" abdominal surgeries [21].

In addition, the need and potential risks of carbohydrates load used for type 2 diabetes patients is of particular interest. A series of conducted research proved that the above patients demonstrated the same time of gastric emptying as patients without diabetes and without the increase of the aspiration complications rate. However, postprandial peak levels of glycaemia among type 2 diabetes patients were significantly higher, and the time of glucose levels regression to the initial levels was longer (up to 180 minutes) than demonstrated by patients without carbohydrate metabolism disorders [22].

The above issues also require further study, in particular in respect of impact of the carbohydrates load on the rate of postoperative complications among patients suffering from diabetes – in particular among patients suffering from gastrointestinal forms of diabetic autonomic neuropathy, who may have significantly longer time of gastric emptying [23].

PREOPERATIVE FASTING.

Approaches to patient food intake immediately prior to the surgery in the context of ERAS are becoming more liberal. Data of actual research demonstrate that food intake 6 hours and 300 ml of liquid 2 hours prior to the administration of anaesthesia does not increase the gastric volume and does not significantly affects the acidity of the residual gastric content in comparison with patients who fasted throughout the night prior to the surgery [21]. Identical data were obtained also from baseline studies when comparing sub-populations of type 2 diabetes patients (including those with gastrointestinal neuropathy) and patients without diabetes. Therefore, the hypothesis on the increased risk of aspiration complications occurrence due to liberalisation of food intake regime prior to the surgery, is now considered to be effectively refuted.

However, contemporary original literature sources still indicate the need to conduct further research, especially in

respect of diabetes patients in order to form recommendations with higher level of evidence reliability [24].

INTRAOPERATIVE PERIOD

LAPAROSCOPIC SURGERY

Prioritisation of laparoscopic access in bariatric/metabolic surgery is now deemed to be a proven fact and is explained by lower rate of postoperative complications, reduced duration of stay in a hospital and recovery period, significantly lower levels of postoperative pains and better cosmetic effect in comparison with "open" surgeries. Discussion on potential advantages of "open" surgery related to the possibility of tactile dissection and more unobstructed performance of supporting procedures, was essentially closed in the beginning of the XXI century. Since 2011 and till now, almost 100% of metabolic surgeries in the world are performed laparoscopically. Possible problems at the stage of mastering the techniques, especially in respect of patients with morbid super-obesity, can be eliminated very quickly by gaining experience. Significant impact of carboxypneumoperitoneum on the duration of postoperative recovery also was not proven [25].

At present, minimally invasive surgery techniques actually became central and key element of ERAS, which allow realising its main principles to the fullest extent [25].

NASOGASTRIC INTUBATION

Routine use of nasogastric tubes in order to prevent failure of gaster sutures and gastroenteric anastomosis, postoperative gastrostasis, enteroparesis, was deemed to be quite appropriate until recently. However, according to the results of the latest research that included also bariatric patient population, placing nasogastric tube does not lead to a decrease in the rate of the above complications, does not significantly affect the duration of recovery of active vermicular movement and passage, and does not reduce the period of patients' stay in a hospital. Moreover, according to some authors, use of gastric tubes during a postoperative period facilitates nausea occurrence rate, increased rate of bronchopulmonary and intra-abdominal complications [26].

Therefore, at present the optimal approach in ERAS system is the utilisation of gastric tubes when needed, predominantly only in an intraoperative manner with following removal thereof immediately after the completion of the surgery [26].

ABDOMINAL DRAINAGE

The practice of routine (mandatory, preventive) abdominal drainage, which was traditionally based on the need of early diagnostics of intraabdominal complications (primarily failure of stapler sutures line or anastomosis and postoperative bleeding), now is reasonably questioned [27]. A number of authors demonstrated that routine use of drainage in metabolic surgery not only does not decrease, but on the contrary increases the rate of the above complications, repeated surgery and hospitalisations, creates preconditions for occurrence of inflammatory processes in the abdominal area [27] while not affecting significantly the rate of early infection occurrence. At the same time, absence of pathological discharge through the drainage from the abdominal cavity cannot reliably eliminate the possibility of postoperative complications.

Even though the level and quality of evidence still do not allow reaching unambiguous conclusions on the expedience of preventive drainage of patient abdominal cavity after metabolic surgeries, at present there is a quite high possibility of the fact that approaches to drainage will become more selective and indications for use thereof will be significantly limited [28].

STANDARDISATION OF ANAESTHETIC PROTOCOL

Comprehensive use of ERAS is possible only if certain standardised principles of anaesthetic management of a patient throughout the surgery are complied with. At present, the key principles include positioning of a patient on the operating table with elevation of the upper body (reverse Trendelenburg position or "beach chair position"), which, especially in the event of pneumoperitoneum, improves breathing biomechanics, allows avoiding using opioids of prolonged effect, which in turn allows avoiding adverse effects associated with the use thereof (including the so-called "opioid paradox" and drug addiction), adherence to the strategy of restrictive targeted infusion therapy in order to safeguard the patient from hypervolemia [29]. No less important is also the infiltration of trocar puncture sites of the abdominal wall with local anaesthetics and using the regional anaesthesia methods (in particular, TAP- and RS-blocks), prevention of intraoperative hypothermia (including heating of carbon dioxide for pneumoperitoneum), controlling the depth of anaesthesia via conducting Bispectral index monitoring [30].

At the same time, in respect of options for the regional anaesthesia, it is worth note the following. Even though according to the ERAS, the most optimal procedure for performing "open" abdominal surgeries is still deemed to be thoracic epidural analgesia, the use of this method in the metabolic surgery is significantly limited due to quite high rate of complications caused as a result thereof. At the same time, findings of a number of scientific papers allow us to conclude that while using laparoscopic access, the safe and efficient alternative to the above anaesthesia option is the use of multilevel afferent blocks of the abdominal wall, which can be performed under ultrasound or laparoscopic control. The data obtained require further confirmation in randomised clinical research [31, 32].

POSTOPERATIVE PERIOD

EARLY PATIENT ACTIVATION AND THROMBOPROPHYLAXIS.

In view of the rapid increase in the number of metabolic surgeries performed annually around the globe, it can be

said that even considering low overall level of mortality, the number of deaths in contemporary metabolic surgery makes tens of thousands of cases [33]. Among those deaths, over 50% are due to thromboembolic complications. Taking into account the fact that ERAS provides for shortening the duration of stay in a hospital, the majority of venous thromboembolic episodes currently occur at the ambulatory stage, most often during the first month after the surgery [33]. Therefore, the issue of thromboprophylaxis in the metabolic surgery undoubtedly remains pertinent.

It is worth noting that for patients suffering from obesity and metabolic syndrome, a characteristic pathogenetic feature is a prothrombotic state. This dictates the need for in-depth assessment of patients prior to the surgery and individual assessment of venous thromboembolic episodes occurrence risks. The optimal strategy is aimed at prevention of the above complications among those patients and at present comes to the combination of mechanical compression (compression stockings/socks or intermittent pneumatic compression of the lower extremities) and using drugs for prevention of such episodes during implementation of ERSA protocols (laparoscopic surgery and patient early activation within 4–6 hours after the surgery). Preventive use of cava filters did not prove decrease in the venous thromboembolic episodes rate among obese patients and therefore is considered impractical at present [34].

In-depth study of pharmacological prevention of thromboembolic complications has proven the advantage of low molecular weight heparin drugs (the most studied among those drugs is deemed to be enoxaparin) over the use of unfractionated heparin. According to the current recommendations, drug-based prevention of venous thromboembolic episodes for obese patients is advisable to commence 12–36 hours prior to the surgery with the first postoperative administration of enoxaparin not earlier than 6 hours after the surgery and maintaining the administration intervals of 12 hours (twice a day). A single subcutaneous dose of the drug in metabolic surgery is 3,000–4,000 anti-Xa IU for patients within the VTE low-risk group, and 4,000–6,000 anti-Xa IU for patients within the VTE high-risk group [35].

The issue of using low molecular weight heparin drugs is still subject to discussion. Advocates of prolonged thromboprophylaxis (up to 28 days of postoperative period) substantiate their position by significant (from 0.3 to 2.2%) increase of venous thromboembolic episodes rate during the period from 7 to 30 day after the surgery [33].

At the same time, recent research papers do not show the increased rate of the above complications when using so-called "restrictive" prevention strategy utilising low molecular weight heparin drugs only during the hospital stage (1-3 days) when utilising comprehensive ERAS principles. Among those principles, the biggest role has laparoscopic access, reducing the duration of the surgery and patient early activation (within 4-6 hours after the surgery) [4].

European recommendations of perioperative prevention of venous thromboembolic episodes when performing surgery on obese patients state that optimal duration of administration of low molecular weight heparin drugs for the majority of patients, with due regard of the above contradictions, is 10–15 days [34].

Prospects of solving the above problem may be related to individualisation of the thromboprophylaxis programme, which is based on achieving anti-factor Xa target preventive levels for each specific patient and utilisation of Xa factor selective inhibitors [35].

MULTIMODAL ANALGESIA

Multimodal analgesia within the ERAS system provides for utilisation of a combination of simultaneous systemic and regional mechanisms for pain management, synergistic interaction between which leads to significant increase of analgesic effect and allows administering lower doses of each of the pharmacological agents compared to other modes of analgesia.

Such approach, which is based on different-level (peripheral and central) effect on forming and transmission of pain impulse, allows reducing the risks of side effects of each specific drug and minimising or avoiding at all administration of opioid analgesics [36]. An important factor in ERAS system is objective assessment of the pain syndrome acuity using contemporary graded scales for assessment thereof, since being guided solely by patient's subjective sensation leads in most cases to underestimation of the pain and essentially makes it impossible to implement an important *pre-emptive* principle (proactive analgesia) [36].

Basic analgesia during early postoperative period according to the multimodal analgesia protocol is achieved via a combination of paracetamol (daily dose of up to 4 g/day) and one of non-steroidal anti-inflammatory drugs (selective or non-selective) [37]. No less important for ensuring "pain comfort" after the surgery are the above-mentioned regional afferent blocks of the abdominal wall [31]. When analgesia level is insufficient, it is appropriate to use opioids for pain relief (the so-called "rescue analgesia"). At the same time, the decision to use opioid analgesics in the metabolic surgery must be carefully weighed with due regard for its suppressive effect on the respiratory centre (especially for patients with obstructive sleep apnoea syndrome. It is advisable to move as early as possible from parenteral to oral administration of analgesics in order to decrease the rate of catheter-caused or infectious complications [36].

PREVENTION OF POSTOPERATIVE NAUSEA/VOMITING

Postoperative nausea is a significant problem in the metabolic surgery affecting, according to the data of various authors, 18–82% of patients and quite often is the cause of repeated hospitalisation or postponement of discharge from a hospital [38]. Current research and practical recommendations developed based on thereof, are focused on multimodal approach to prevention of postoperative nausea and vomiting using a combination of antiemetic drugs based on assessment of risk factors for each specific

patient [39]. The above strategy provides for prioritised use of propofol for induction and maintenance of anaesthesia, minimisation of opioids utilisation (including implementation of non-opioid protocol) during and after the surgery, restrictive option of infusion therapy [39]. Randomised clinical research conducted in the recent years on the use of antiemetic drugs evidence significant advantages of preventive use of haloperidol/dexamethasone/ondansetron combination in comparison with combination of only two drugs or monotherapy [39].

It is worth noting that despite compiled systematic best practices, the problem of postoperative nausea and vomiting in the metabolic surgery remains far from the final solution and requires further study.

FOOD INTAKE DURING POSTOPERATIVE PERIOD

ERAS system in the abdominal surgery field stipulates renewal of oral food intake as soon as possible: renewal of water intake – in 2-3 hours after the end of the surgery, consumption of liquid and semi-liquid food – on the first postoperative day with a gradual concentration of food density throughout several weeks or months. According to the results of recent studies, such an approach ensures reducing the perioperative stress, the rate of postoperative complications and mortality, facilitates rapid recovery of peristaltic action of the intestinal tract, shortens the duration of inpatient treatment [40].

Even though the above principles are currently being actively implemented in the metabolic surgery, the majority of authors acknowledge that for complete understanding of the risk/benefit balance of early renewal of food intake, further conduct of randomised clinical research is necessary [4].

It is worth noting that type 2 diabetes patients require more careful attention during the food intake renewal stages, since combination of early incretin (proinsular) effects of the surgery, decrease of body weight, forced diet and food intake regime may significantly affect the carbohydrate metabolism regulation. All of the above, especially in view of administration of anti-diabetic drugs without proper correction of its dosage and treatment regimen, may lead to undesirable hypoglycaemia episodes [40]. Therefore, careful glycaemia monitoring and addition into the multidisciplinary team of an endocrinologist, are important factors of the overall success within ERAS system.

CONCLUSIONS

Implementation of modern approaches allowed for significant improvement of the results of metabolic surgeries and bringing it as close as possible to the concept of "one-day surgery". Indeed, as contemporary literature sources analysis shows, the duration of hospitalisation in modern metabolic surgery centres is within the range of 1 to 3 days, while sometimes patients are even discharged on the same day of the surgery. Such reduction of time of stay in the hospital and transition to "remote patient follow-up", on the one hand, fits perfectly the essence of the ERAS and becomes even more relevant amidst the COVID-19 pandemic, while on the other hand, puts forth even more strict requirements to the quality of hospital care services. At the same time, specific features of type 2 diabetes patients indicate the need for their separation into a specific group. This is important because the above-mentioned patients face additional inherent perioperative risks, which may, inter alia, be related to the implementation of both individual elements of ERAS and ERAS system as a whole.

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